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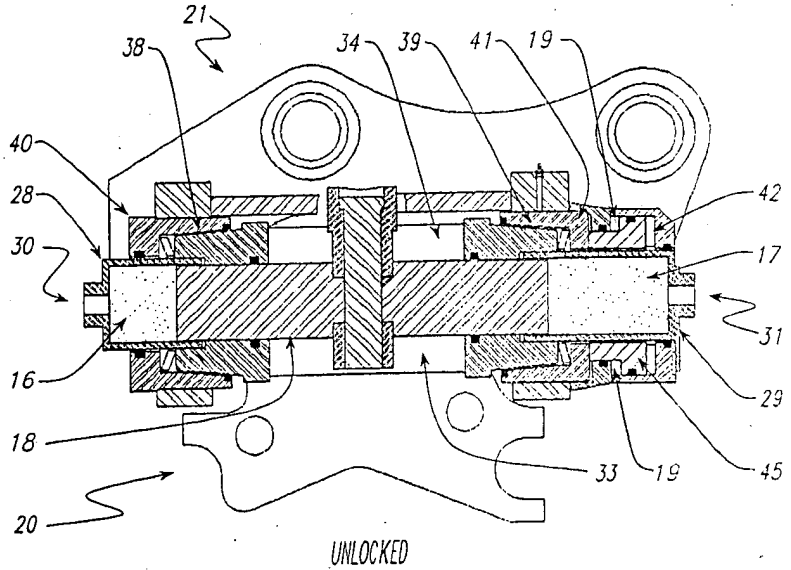
(54) Title: A LOCKING DEVICE



(57) Abstract: A linear to rotary convertor automatically assumes a locked position when controlling drive forces are terminated, the convertor employs a double acting hydraulic cylinder assembly with hydraulic fluid applied at (16 and 17) on opposite sides of a main piston in the form of a scroll cylinder shaft (18). Once the tapered locking elements are in position, hydraulic fluid to (16 and 17) is irrelevant to the continued operation of the assembly which is essentially and effectively a rigid coupling between the standard quick hitch ears (20) and pin ears (21). A locking spring disk (42) normally overcomes the unlocking spring disks (43 and 44) so that the cones (36, 37, 38 and 39) are in locking register. On application of the first drive means hydraulic fluid is delivered into the annular space illustrated at (19) to assist the springs (43 and 44) to overcome the bias of the locking spring (42) by moving unlocking piston (45) to the right thereby enabling the unlocking springs (43 and 44) to apply separating bias to release the engagement of the cone surfaces (36, 37, 38 and 39) so that application of hydraulic fluid under pressure at (16 or 17) will cause the scroll cylinder shaft (18) to rotate and thereby rotate the ears (20) to a desired position. Upon release of hydraulic pressure to the first drive means, the device will automatically revert to the locked position. A second embodiment uses a first hydraulic pressure to unlock the cones and then a second higher pressures applied to both maintain the unlocking pressure but also as a differential across the main piston to rotate the output. This provides a single joystick control where an operator selects the required angle and the unlocking and rotation actions are initiated under the single manual control.

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A LOCKING DEVICE

TECHNICAL FIELD OF THE INVENTION

THIS INVENTION relates to a locking device and in particular but not limited to a locking device employing an automatically locking helical guided linear to rotary convertor suitable for rigidly locking a tiltable tool of an earth moving vehicle in position over an infinitely variable range of angles.

BACKGROUND TO THE INVENTION

US patent No. 5,145,313 to Paul P. Weyer describes a quick disconnect bucket actuator for a back hoe arm which is able to tilt the bucket about an axis transverse to the horizontal pivot axis of the bucket attachment to the arm. The tilt is accomplished using a double acting hydraulic cylinder assembly having an annular piston constrained by a helical guide to rotate as it is driven axially by the hydraulics. This arrangement has the disadvantage of the bucket being held in its selected position by maintenance of hydraulic pressure on the piston, thus loading the piston as the bucket is being used.

EP 0 356 738 also to Paul P. Weyer describes a similar arrangement. In this case the axial piston is still loaded when the bucket is in use, this patent attempts to overcome problems associated with loading of the helical guide by a complex adjustment of rollers which travel in the guide and the use of thrust bearings.

AU-A-40383/95 also to Paul P. Weyer describes a device virtually the same as that of US patent No. 5,145,313 in so far as it employs the same axially moveable and rotatable annular piston arrangement.

It is an object of the present invention to provide an alternative to the abovementioned prior art whereby the driving force used to rotate the output is not used to hold the device in operative position but rather a releasable locking means is employed to lock the output at a selected position.

OUTLINE OF THE INVENTION

In one aspect therefore the present invention resides in a locking device having a main body, a rotatable body coupled to the main body and being able to rotate relative to the main body and releasable locking means engaging the rotatable body to lock the rotatable body against rotation relative to the main body,

the releasable locking means being automatically biassed to a normally locked position and there being release means employed to first release the locking means thereby enabling the rotatable body to be rotated as may be required. The operation of the release means and rotation of the rotatable body may be completely manual or may employ manual and automatic elements. Preferably, the locking device employs cooperating drive means operable in controlled fashion.

Typically, three or four drive means are employed, the first two being active and controlled whereas the third is passive and automatic in its function. In the case where the device is normally in the locked position, the third drive means is preferably biassing means urging the releasable locking means into a locked position, the first drive means being operable to overcome the third drive means and assist a fourth drive means to release the locking means. Typically, the third and fourth drive means are opposing springs while the first and second drive means are hydraulic drive means.

Preferably, the locking device includes a linear to rotary convertor where the first and second drive means drive respective axially moveable pistons. The first drive means driving the release means which is in the form of an unlocking piston and the second drive means driving a main piston being part of a cylinder assembly supported by the main body, and there being control means operating said first and second drive means sequentially to first release the releasable locking means from engagement with the rotatable body using the first drive means and then rotate the rotatable body using the second drive means and subsequently cause re-engagement of the releasable locking means with the rotatable body to thereby lock the rotatable body against further rotation. The first drive means typically operates in conjunction with third and fourth drive means comprising opposed biassing springs, these being a relatively strong locking spring and a relatively weak unlocking spring, the first drive means overcoming the locking spring bias allowing the unlocking spring to force release of the locking means.

In another form the control means comprises a hydraulic control means and the first and second drive means are pressurised through a common hydraulic drive

operable in sequence to firstly unlock the locking means at a first hydraulic pressure and then apply a pressure a differential pressure to rotate the rotatable body.

Where the control means is hydraulic the hydraulic pressure is preferably employed to unlock the device but the device is not under the influence of hydraulic pressure when it reverts to the locked position.

In one preferred aspect the invention resides in application to a tiltable tool assembly for a machine having an articulated arm with the tool assembly mounted at the end of the arm. The tool is usually mounted on the arm by a hitch assembly. The present invention enables the tool assembly to controllably tilt and be held in a predetermined position, the locking device being between the articulated arm and the tool and usually being part of the hitch assembly.

Where a linear to rotary convertor is employed, the second drive means typically comprises the operative elements of a double acting hydraulic cylinder assembly. The adaptation of the convertor for linear to rotary conversion being preferably by means of a guide and co-operating guide way. Preferably, the main piston moves within a main body, the guide projecting from the main piston and the guide way being carried by the main body, the guide way being axially inclined to cause rotation of the main piston in the manner of a helical motion of the guide along the guide way. Thus, the double acting hydraulic cylinder assembly is able to rotate one way or the other as driving fluid is delivered in turn to the opposite sides of the double acting hydraulic cylinder assembly giving forward and reverse motion of a rotary output. In the case of a tool assembly the output from the convertor would usually be a known tool hitch, typically a so-called "quick hitch."

The first drive means typically includes a hydro-mechanical lock releasably engaging the rotary output, the lock preferably comprises an axially moveable locking piston having a main piston engagement means to rigidly and releasably hold the rotary output relative to the main body. Preferably, the rotary output and the locking piston have co-operating cones. The locking piston may be part of a double or single acting hydraulic cylinder assembly. Preferably, the locking piston is part of a single acting hydraulic cylinder assembly operating as the first drive

means in conjunction with third and fourth drive means comprising opposed biassing springs biassing the locking piston to a to a normally locked position.

The control means typically comprises a hydraulic circuit selectively delivering hydraulic fluid in sequence to the drive means to first unlock and then rotate the output. In the case where a convertor is employed in a normally locked position the control means usually operates the first drive means to unlock the convertor followed by the second drive means to rotate the output and then the first drive means is deactivated thereby automatically locking the output at a new position.

In order that the present invention may be more readily understood and be put into practical effect, reference will now be made to application of the present invention to a hitch for a tiltable bucket on an excavator, but it will be appreciated the example applies generally to tools including rippers, hammers, rollers, blades and mowers. Moreover, the invention can be used anywhere where controllable rotation and in particular self locking controllable rotation is desired.

BRIEF DESCRIPTION OF THE INVENTION

Figures 1A and 1B are perspective views illustrating a tiltable bucket at ninety degree extremes between right and left tilted positions;

Figure 2 is an exploded view of a hitch assembly employing a locking device according to the present invention;

Figure 3A and 3B are axial sections illustrating the locking device in unlocked and locked positions respectively;

Figure 4 is a hydraulic circuit schematic illustrating a typical control means suitable for controlling the locking device illustrated in Figures 1A to 3B.

Figures 5A and 5B are drawings similar to Figures 3A and 3B illustrating an alternative embodiment employing a common hydraulic unlocking and rotation feature but retaining the self locking function of the previous embodiments, like numerals illustrate like features;

Figures 5C and 5D are enlarged sections showing the embodiment of Figures 5A and 5B in unlocked and locked positions respectively; and

Figure 6 is a hydraulic circuit schematic illustrating typical control means suitable for control of the locking device of Figures 5A though 5C.

METHOD OF PERFORMANCE

Referring to the drawings and initially to Figures 1A and 1B there is illustrated a bucket assembly 10 including a bucket 11 releasably held by a hitch assembly which is typically a quick release hitch assembly 12 (details being omitted for sake of clarity) and in this case employs a locking device in the form of a linear to rotary convertor 13 between industry standard couplings altogether securing the bucket to, in this example, an articulated arm assembly 14 of an earthmoving vehicle(not shown). The linear to rotary convertor 13, and consequently the bucket assembly, includes a visual readout, in this case a scale and pointer at 15 which enables an operator to visually identify the angular position of the bucket from the scale. As can be seen in Figure 1A the bucket is tilted to the right at forty-five degrees and in Figure 1B it is tilted to the left at forty-five degrees. A joystick controller(not shown) is employed to control the bucket position preferably using hydraulic drives and control to be described below.

As will be appreciated from the following description the bucket 11 can be rotated continuously through the full ninety degree range and can be selectively locked at any angular position within that range. It will be appreciated, however, that in relation to the tilting of a bucket assembly, while a ninety degree angular range may be applicable, in this and other applications the linear to rotary convertor can be configured for other angular ranges as may be desired.

Referring now to Figures 2, 3A and 3B construction of the linear to rotary convertor and its operation will now be described and illustrated. As can be seen most clearly in Figures 3A and 3B, the linear to rotary convertor employs a double acting hydraulic cylinder assembly with hydraulic fluid illustrated in dotted form at 16 and 17on opposite sides of a main piston in the form of a scroll cylinder shaft 18 and there being a first drive means to unlock the device, the hydraulic fluid for the first drive means being illustrated in the dotted section at 19 in Figure 3A, it being appreciated that the second drive means is the double acting cylinder assembly and a fully automatic cone locking structure is utilised at opposite ends

of the assembly and this can plainly be seen in Figures 3A and 3B. It will be appreciated from the following description that the normal operating position of the assembly is in a "locked" position by reason of third and fourth drive means in the form of opposed biassing springs and that hydraulic fluid under pressure to the first drive means is used to overcome a stronger locking spring and to enable a weaker unlocking spring to "unlock" tapered locking elements of the locking device and during normal "locked" operation there is no need for hydraulic pressure to be maintained to the locking device once it is in a desired position since it is mechanically locked solely by springs. It will also be appreciated that once the tapered locking elements are in position, hydraulic fluid to 16 and 17 is irrelevant to the continued operation of the assembly which is essentially and effectively a rigid coupling between the standard quick hitch ears 20 and pin ears 21.

The ears 21 are part of a rotary output in main body 22, the main body 22 having a scroll plate 23 which has a helical slot 24 forming a scroll guide way co-operating with a scroll guide 25. The scroll guide 25 is pinned to the scroll cylinder shaft 18 by a guide block 26 and a scroll guide fixing pin 27. As the cylinder 18 is driven axially it is caused to rotate by the guide 25 travelling along the guide way 24 in a helical fashion.

The scroll cylinder shaft 18 travels at opposite ends in respective first and second scroll cylinder barrels 28 and 29 which have respective hydraulic fluid inlets 30 and 31, the guide block 26 and the square guide section 32 of the guide 25 travel axially in guide slots 33 and 34 respectively, the slots 33 and 34 are formed in a second body 35 which is formed integrally with the ears 20. It will therefore be appreciated that the second body 35 and the ears 20 rotate in concert with the scroll cylinder shaft 18 as the guide 25 moves along the guide way 24 but that the two bodies are locked together by the tapered locking elements. The body 35 has opposite cones 36 and 37 which are matched to internal cone surfaces 38 and 39 respectively of fixed tapered cup 40 and sliding tapered cup 41 respectively. Sliding tapered cup 41 is splined against rotation relative to the main body.

A locking spring disk 42 normally overcomes the unlocking spring disks 43 and 44 so that the cones 36, 37, 38 and 39 are in locking register and the assembly

is in the position illustrated in Figure 3B. On application of the first drive means hydraulic fluid is delivered into the annular space illustrated at 19 to assist the springs 43 and 44 to overcome the bias of the locking spring 42 by moving unlocking piston 45 to the right thereby enabling the unlocking springs 43 and 44 to apply separating bias to release the engagement of the cone surfaces 36, 37, 38 and 39 so that application of hydraulic fluid under pressure at 16 or 17 will cause the scroll cylinder shaft 18 to rotate and thereby rotate the ears 20 to a desired position as can be read directly off the scale 15 of Figure 1A and 1B. Upon release of hydraulic pressure to the first drive means, the device will automatically revert to the locked position.

While the above description has been in relation to a hydraulic linear to rotary convertor it will be appreciated that other drive means including pneumatic drive means or simple manual release and rotation may be employed in circumstances that warrant. Manual control is clearly possible by reason of the use of springs to provide the locking function as a passive device, consequently it is simply a matter of substituting manual drives for the first and second drives.

The following description is in relation to a typical hydraulic circuit illustrated in Figure 4 that can be used to control the drive means on a bucket.

1. Hydraulic pressure is supplied to port "P" on valve 1 shown via a Tee connection from a main hydraulic pump pressure outlet.

2. Flow to port "A" of valve 1 is only permitted by selection of either direction "tilt" function on a joystick or similar, providing subsequent energisation of a solenoid on valve 1 moving said valve to provide a function permitting flow to port "A" on valve 1. Dependant upon the direction of tilt selected by a joystick or similar, a related solenoid on valve 2 is simultaneously energised to move valve 2 to provide either extend or retract function to the scroll shaft 18 although no pressure is yet available at port "P" on valve 2. (Note: The operator holds the "tilt" selector (joystick or similar) in the tilt position for the time required to tilt the bucket by the required amount.)

3. The "Unlock" cylinder assembly shown schematically at 3 extends due to pressure from port "A" on valve 1 and subsequently releases the spring bias

on the locking elements of the convertor and this is represented in Figure 4 by the unlock function at 3.

4. Upon reaching and overcoming a set relief pressure of valve 5, oil flow is then also directed to port "P" on valve 2 with subsequent flow directed through the valve via the held valve function determined by operator selecting and holding "tilt", this applies pressure to the selected end of the scroll cylinder shaft 18 as depicted in the schematic at the tilt function 4.

5. Upon reaching the desired amount of tilt, the operator will release the "tilt" selector, which will spring return to a centre off position.

6. Solenoids on Valves 1 & 2 will become de-energised and spring bias within these valves will return them to their normal operating positions, as shown on hydraulic schematic of Figure 4.

7. Oil flow through valve 2 will become blocked by virtue of its normal function in this state and prevent movement of the tilt function.

8. Oil pressure will be directed through valve 1 by virtue of its normal function to port "T", eliminating pressure from extending the unlock cylinder against spring bias, therefore permitting an automatic locking of the convertor by means of spring bias acting upon the locking elements within the convertor.

9. In the normally "Locked" mode (Figure 4 and Figure 3B), there is NO hydraulic pressure of any means required to lock or prevent tilting hitch from tilting.

Figures 5A through 6 illustrate an alternative embodiment of the invention. In this embodiment it will be clear from a comparison of the drawing figures that the basic structure and operation is the same and accordingly those elements common to the embodiments will not be described in detail. Like numerals have been used to illustrate like features.

The main difference arises from the mode of control which in this case uses hydraulics ported through a common port to initially drive a piston to unlock the device and then while still maintaining sufficient hydraulic pressure to keep the device unlocked a pressure differential is subsequently created across the double acting cylinder assembly on opposite sides of the main piston to rotate the ears of

the quick hitch, when the desired angle is achieved the pressure is released and the automatic locking action follows as previously described.

Instead of using 'unlocking springs' 43 and 44 a hydraulic means of disengaging both engaged locking cones may be used. The description is as follows referring to Figures 5A, 5B, 5C, 5D and 6.

From the normally 'Locked' position, the 'unlock' function involves firstly introducing fluid at equal pressure simultaneously at 19 on both ends, this causes both unlock pistons 46 to extend and force the mating cones 36, 37, 38 & 39 apart forcing locking spring 42 back against its normal bias.

Fluid at pressure 19 is ported by virtue of design through these 'unlocking pistons' to act on respective ends of the double acting scroll cylinder shaft 16 & 17.

Once a pre set pressure is achieved in both ports 19 & also 16 & 17 (by virtue of the hydraulic circuit) then the 'rotate' position is selectively controlled depending upon desired direction of rotation. Subsequent differential fluid pressure is introduced to the two ports at 19 & therefore ports 16 & 17 will see a higher or lower fluid pressure to one another. The means & amount of the differential fluid pressures are by virtue of the hydraulic circuit see fig 6. The end 16 or 17 having the higher of the two pressures will cause the scroll cylinder shaft 18 to extend & therefore rotate the ears 20 to a desired position.

Upon reaching the desired rotation position, the differential fluid pressure at both ends at 19 and therefore 16 and 17 is removed. At this point the locking spring 42 bias returns and the locking cones 36, 37, 38 & 29 return to the engaged position and the entire assembly returns to the normally locked state.

The following description explains the operation of the hydraulic schematic shown in Figure 6 concerning the embodiment of Figures 5A through 5C:

1. Hydraulic pressure is supplied to port 2 of valve 1 from a T-connection from a main hydraulic pump pressure outlet

2. Selecting and holding either direction "tilt" function on a joystick or similar provides subsequent energisation of either solenoid on valve 1 dependant upon the direction of tilt selected therefore moving said valve to provide a function permitting fluid flow to ports 4 and 5 of valve 1 and subsequently to both the

unlocking pistons (19 in Figures 5A and 5B)shown schematically at 6 and to ports A and B of the scroll cylinder shown schematically at 7.

3. A related solenoid on valve 4 is simultaneously energised to move valve 4 to provide either fluid at ports 2 or 3 of valve 4 although no hydraulic pressure is yet available at port 4 of valve 4. (Note: The operator holds the "tilt" selector (joystick or similar) in the tilt position for the time required to tilt the bucket by the required amount.)

4. The "unlocking pistons" shown schematically at 6 extends due to pressure from ports 4 and 5 of valve 1 and subsequently releases the spring bias on the locking elements of the convertor and this is represented in Figure 6 by the "unlocking pistons" at 6.

5. Upon reaching and overcoming a set relief pressure of valve 2, oil flow is then permitted to flow to either ports 2 or 3 of valve 4 with subsequent flow directed through the valve dependant upon the held valve function determined by operator selecting and holding "tilt". This pressure hydraulically pilots valve 1 to move further to the next valve function in the same direction as the held "tilt" selection.

6. Valve 1 then permits flow of fluid at a pressure defined by relief valve 2 to one of the two "unlocking pistons" and the corresponding end of the scroll cylinder 7 (16 or 17 in Figures 5A and 5B).

7. Fluid from the opposing unlocking cylinder 6 and corresponding end of the scroll cylinder 7 flows dependant upon the held "tilt" selection via either ports 4 or 5 of valve 1 through relief valve 5.

8. Relief valve 5 pressure is set at a lower fluid relief pressure than relief valve 2 therefore creating a lower pressure in one of the two unlocking pistons 6 and corresponding scroll cylinder 7. Valve 3 suitably isolates the side of the circuit with the lower of the two pressures and permits a pressure differential between the two sides of the scroll cylinder 7.

9. During the "tilt" period the differential pressures created by virtue of pressure relief valves 2 and 5 is still sufficient to fully extend and hold both "unlock pistons" against the spring bias on the locking elements of the convertor. This

differential pressure between each end of the scroll cylinder also causes scroll cylinder 7 to extend and therefore rotate the ears 20 on Fig 5A and 5B.

10. Upon reaching the desired "tilt" the operator will release the "tilt" selector, which will spring return to a center off position.

11. Solenoids on valves 1 and 4 will become de-energised and spring bias within these valves will return them to their normal operating positions, as shown on hydraulic schematic of Figure 6.

12. Fluid pressure to the pilot ports of valve 1 and fluid pressure to the unlocking pistons 6 and scroll cylinder 7 is relieved to tank eliminating pressure from extending the unlocking pistons against spring bias, therefore permitting an automatic locking of the convertor by means of spring bias acting upon the locking elements within the convertor.

13. In the normally "Locked" mode (Figure 5B and 5D), there is no hydraulic pressure of any means required to lock and thereby prevent tilting hitch from tilting.

Whilst the above has been given by way of illustrative example of the present invention many variations and modifications thereto will be apparent to those skilled in the art without departing from the broad ambit and scope of the invention as set out in the appended claims.

CLAIMS

1. A locking device having a main body, a rotatable body coupled to the main body and being able to rotate relative to the main body and releasable locking means engaging the rotatable body to lock the rotatable body against rotation relative to the main body, the releasable locking means being automatically biassed to a normally locked position and there being release means employed to first release the locking means thereby enabling the rotatable body to be rotated as may be required.

2. A locking device according to claim 1 wherein three drive means are employed, the first two being active and controlled whereas the third is passive and automatic in its function, the third drive means comprises biassing means urging the releasable locking means into a locked position, the first drive means being operable to overcome the third drive means and assist a fourth drive means to release the locking means. Typically, the third and fourth drive means are opposing springs while the first and second drive means are hydraulic drive means.

3. A locking device according to claim 1 wherein three drive means are employed, the first two being active and controlled whereas the third is passive and automatic in its function, the third drive means comprises biassing means urging the releasable locking means into a locked position, the first drive means being operable to overcome the third drive means and assist a fourth drive means to release the locking means, the third and fourth drive means being opposing springs while the first and second drive means are hydraulic drive means.

4. A locking device according to claim 1 wherein the locking device includes a linear to rotary convertor having first and second drive means driving respective axially moveable pistons, the first drive means driving the release means comprising an unlocking piston and the second drive means driving a main piston being part of a cylinder assembly supported by the main body, and there being control means operating said first and second drive means sequentially to first release the releasable locking means from engagement with the rotatable body using the first drive means and then rotate the rotatable body using the second drive means; and subsequently the releasable locking means re-engages the rotatable body to thereby

lock the rotatable body against further rotation.

5. A locking device according to claim 1 wherein the locking device includes a linear to rotary convertor having first and second drive means driving respective axially moveable pistons, the first drive means driving the release means comprising an unlocking piston and the second drive means driving a main piston being part of a cylinder assembly supported by the main body, and there being control means operating said first and second drive means sequentially to first release the releasable locking means from engagement with the rotatable body using the first drive means and then rotate the rotatable body using the second drive means; and subsequently the releasable locking means re-engages the rotatable body to thereby lock the rotatable body against further rotation, the first drive means operates in conjunction with third and fourth drive means, the third drive means comprising a relatively strong locking spring and the fourth drive means comprising a relatively weak unlocking spring, the first drive means overcoming the locking spring bias allowing the unlocking spring to force release of the locking means.

6. A locking device according to claim 1 wherein further including control means comprising a hydraulic circuit and first and second drive means, the first drive means unlocking the releasable locking means and the second drive means rotating the rotatable body, the drive means being pressurised through a common hydraulic drive operable in sequence to firstly unlock the releasable locking means at a first hydraulic pressure and then apply a differential pressure to rotate the rotatable body.

7. A locking device according to claim 1 wherein further including hydraulic control means, where hydraulic pressure is employed to unlock the releasable locking means but the device is not under the influence of hydraulic pressure when it reverts to the locked position.

8. A locking device according to claim 1 including a linear to rotary convertor having a first and second drive means, the second drive means comprises operative elements of a double acting hydraulic cylinder assembly, a guide and co-operating guide way.

9. A locking device according to claim 1 including a linear to rotary convertor having a first and second drive means, the second drive means comprises operative elements of a double acting hydraulic cylinder assembly, a guide and co-operating guide way, the double acting hydraulic cylinder assembly having a main piston moving within a main body, the guide projecting from the main piston and the guide way being carried by the main body, the guide way being axially inclined to cause rotation of the main piston in the manner of a helical motion of the guide along the guide way.

10. A locking device according to claim 1 including a linear to rotary convertor having a first and second drive means, the second drive means comprises operative elements of a double acting hydraulic cylinder assembly, a guide and co-operating guide way, the releasable locking means being driven by the first drive means and comprises a hydro-mechanical lock releasably engaging the rotatable body, the lock comprises an axially moveable locking piston having a main piston engagement means to rigidly and releasably hold the rotatable body relative to the main body.

11. A locking device according to claim 1 including a linear to rotary convertor having a first and second drive means, the second drive means comprises operative elements of a double acting hydraulic cylinder assembly, a guide and co-operating guide way, the releasable locking means being driven by the first drive means and comprises a hydro-mechanical lock releasably engaging the rotatable body, the lock comprises an axially moveable locking piston having a main piston engagement means to rigidly and releasably hold the rotatable body relative to the main body, the rotatable body and the locking piston have co-operating cones.

12. A locking device according to claim 1 including control means, the control means comprising a hydraulic circuit selectively delivering hydraulic fluid in sequence to the drive means to first unlock and then rotate the output.

13. A locking device according to claim 1 including a linear to rotary convertor held in a normally locked position and control means operating drive means to unlock the convertor and then subsequently to rotate the rotatable body and then upon deactivation of the drive means the releasable locking means automatically locks the rotatable body at a new position.

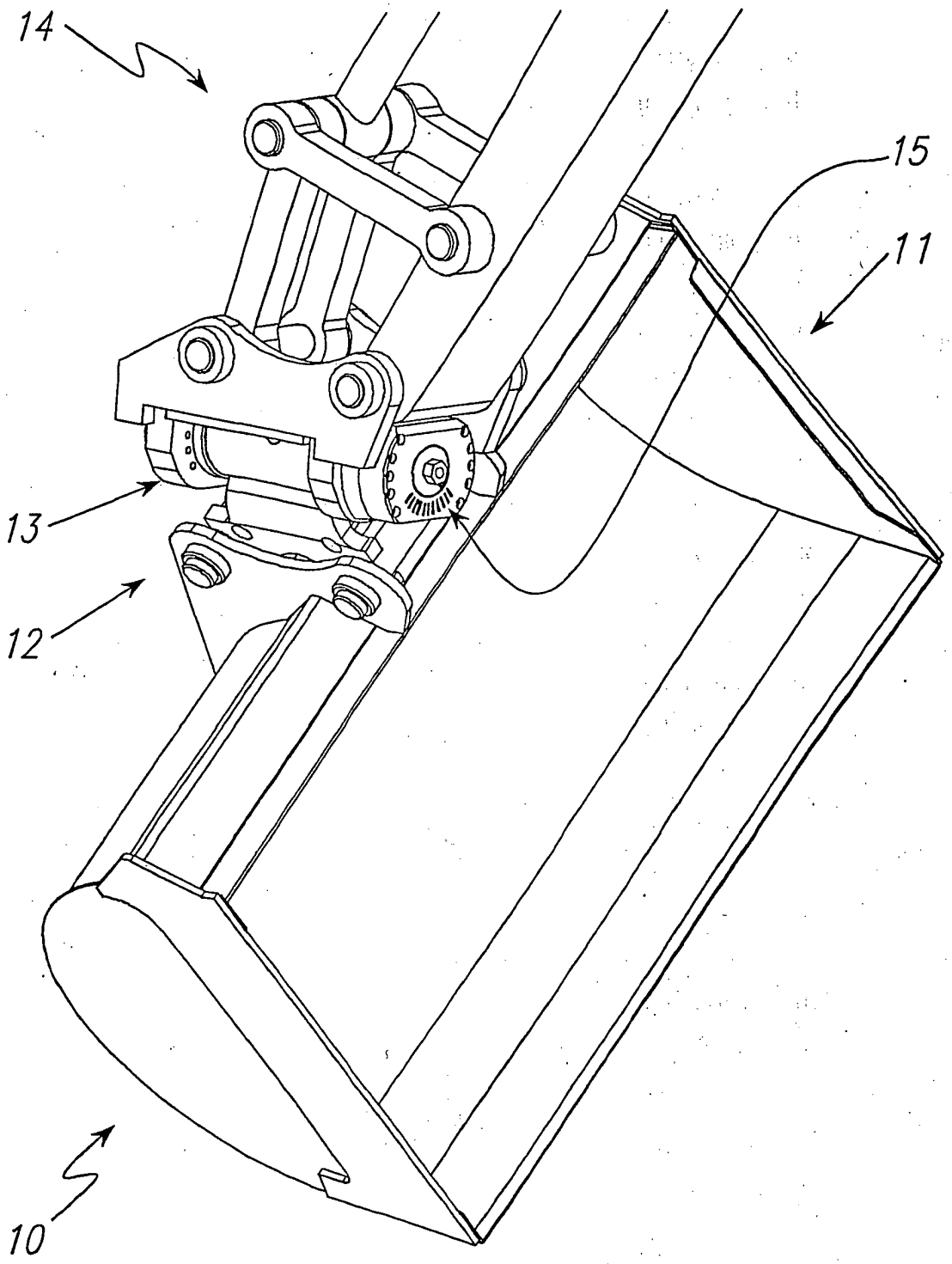

FIG. 1A

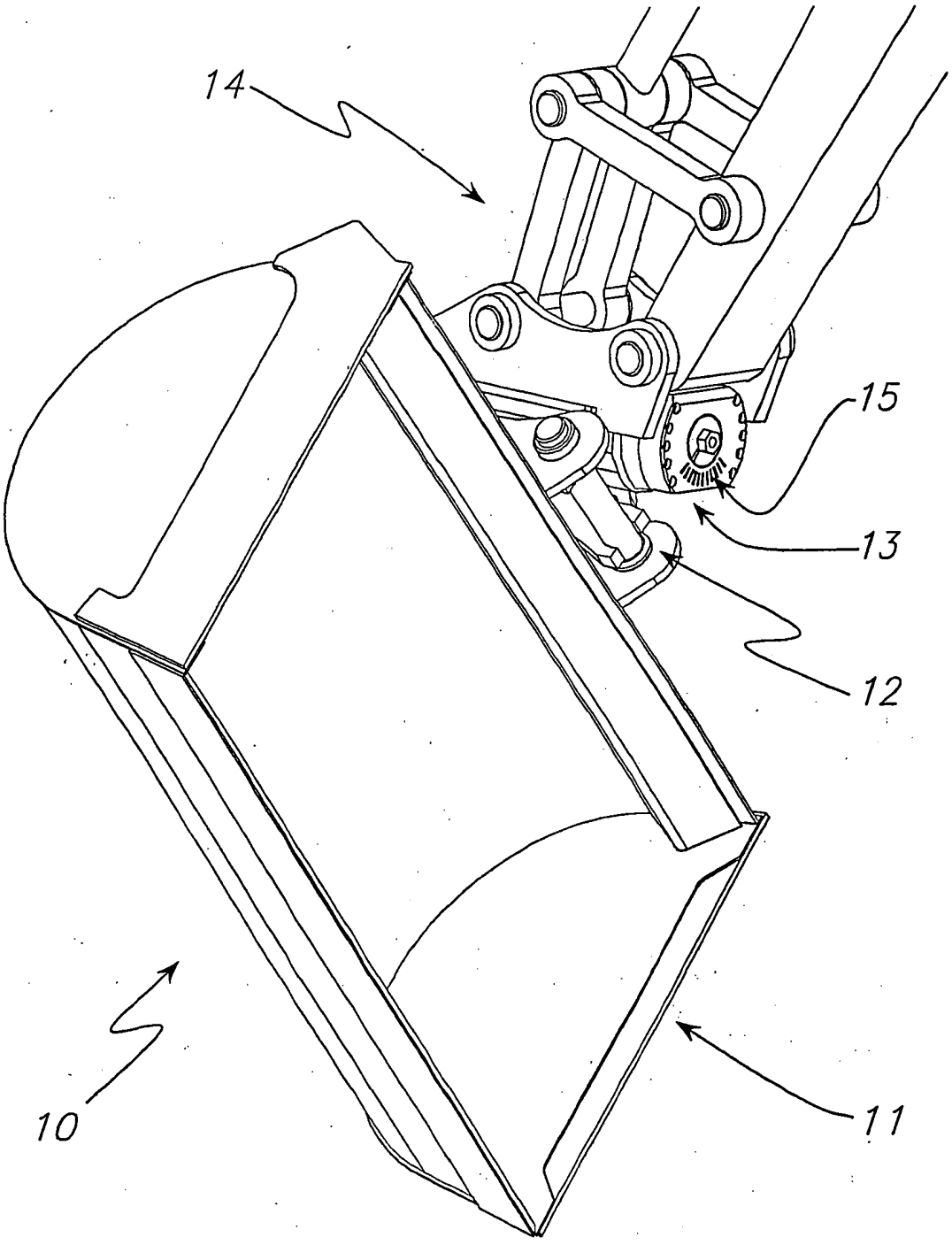

FIG. 1B

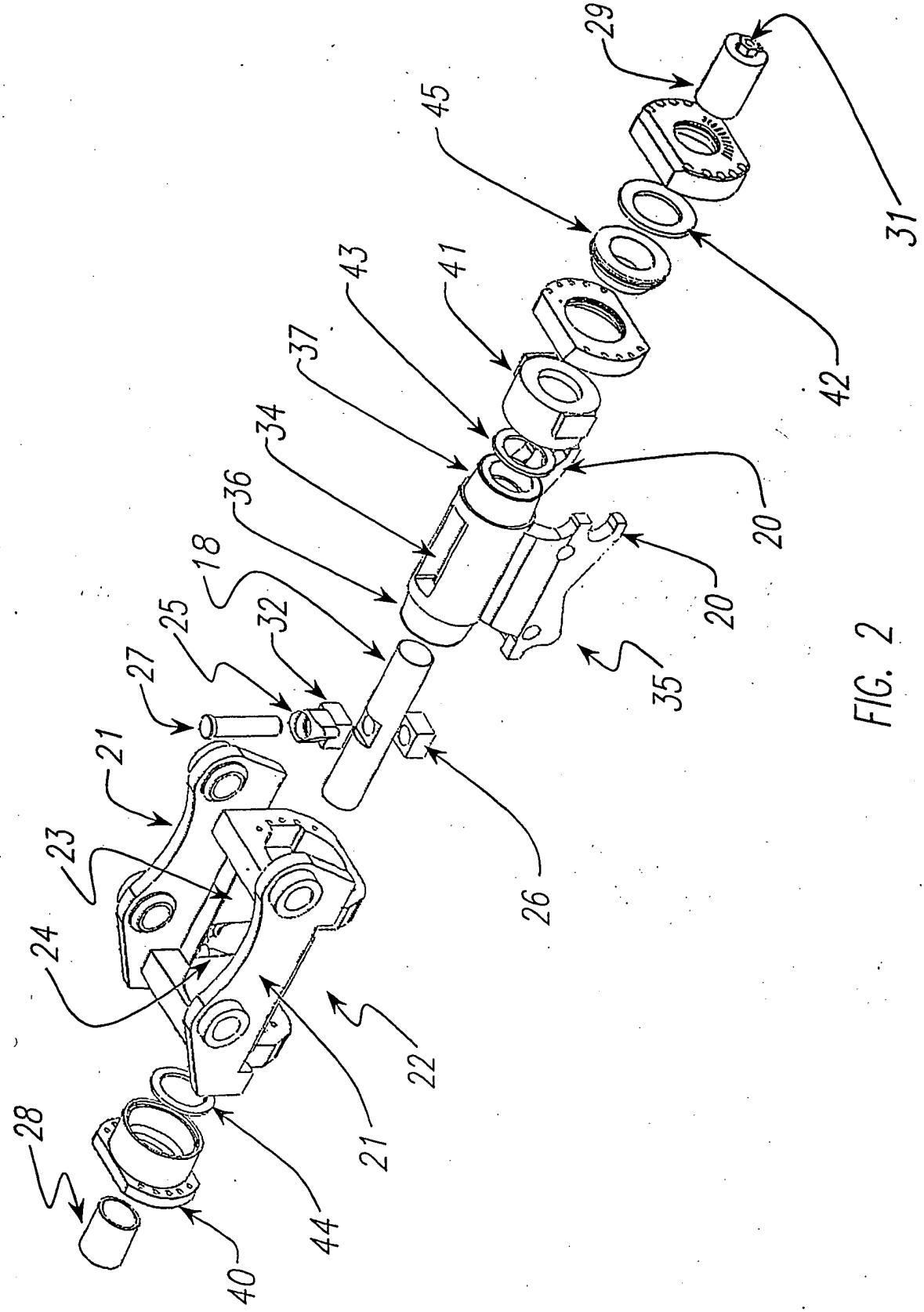
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FIG. 2

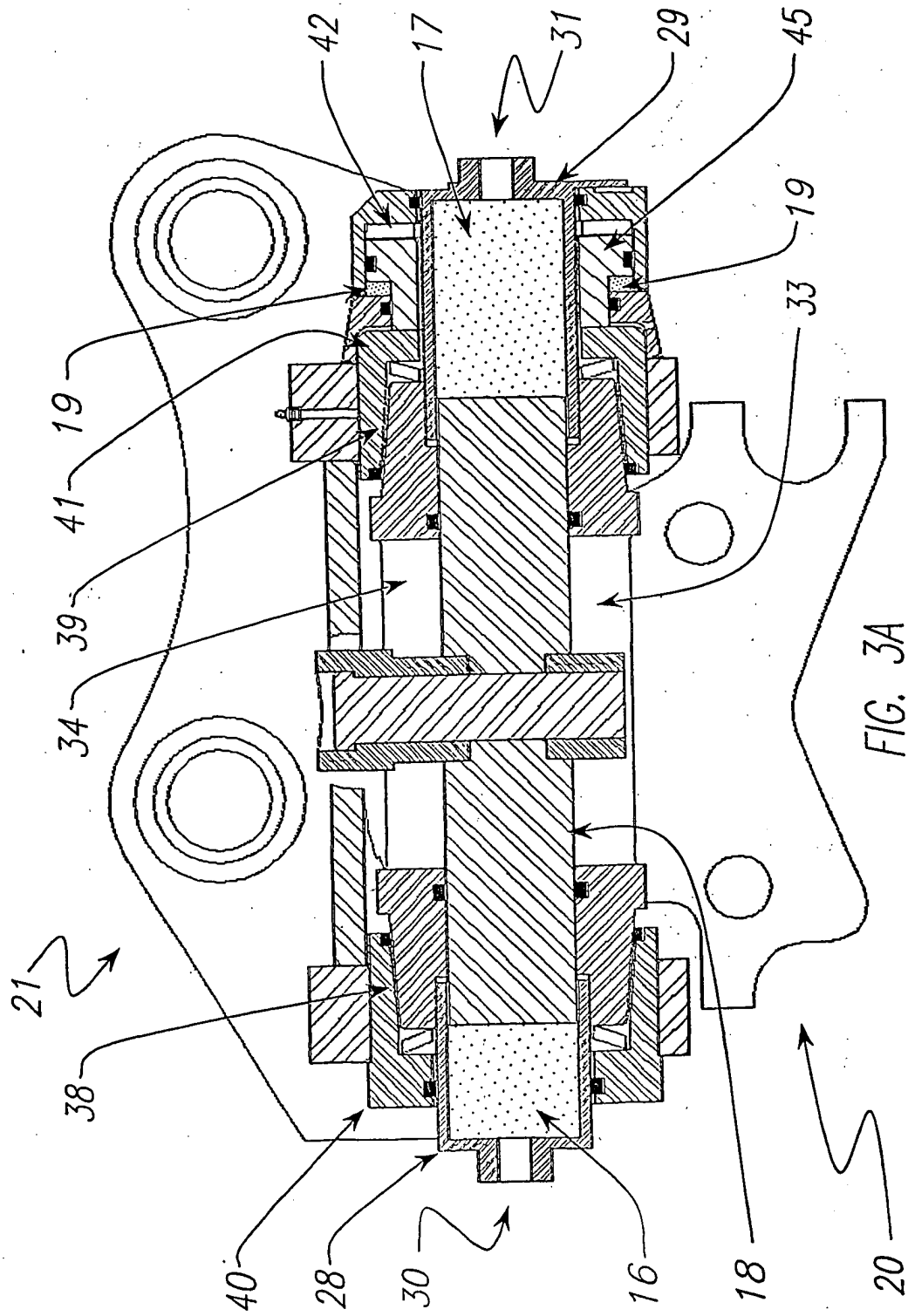

FIG. 3A
UNLOCKED

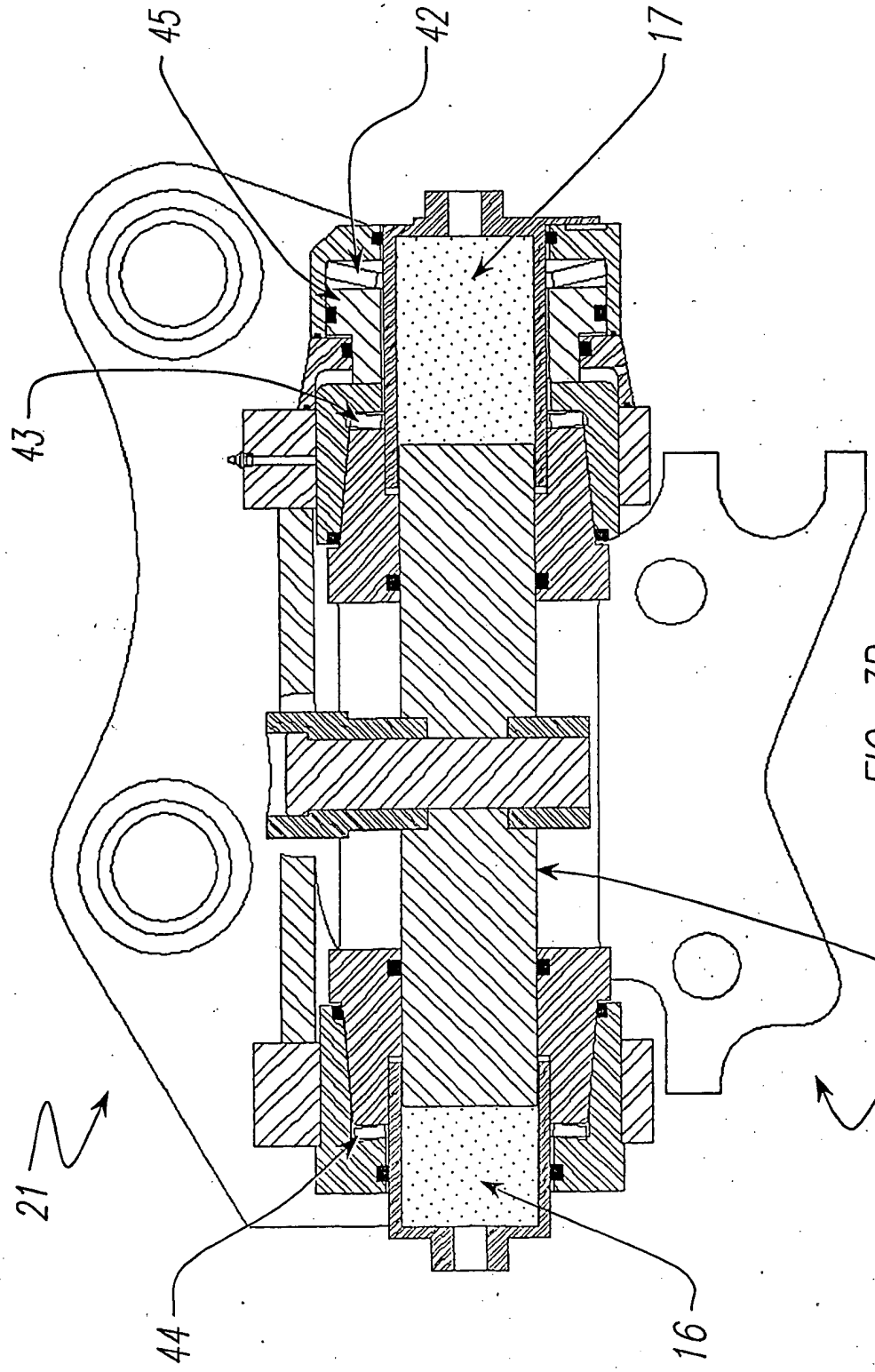

FIG. 3B
LOCKED

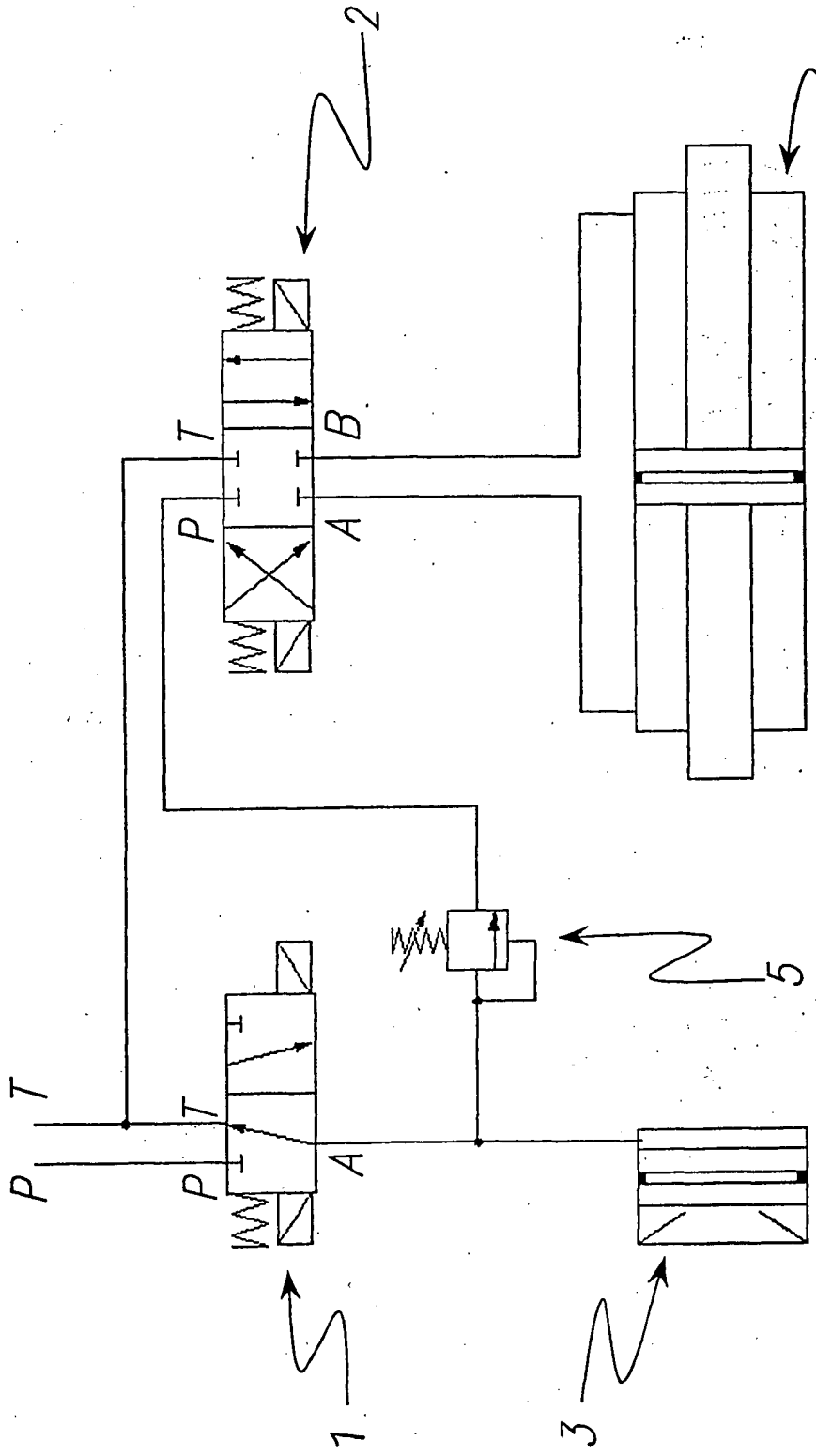

FIG. 4

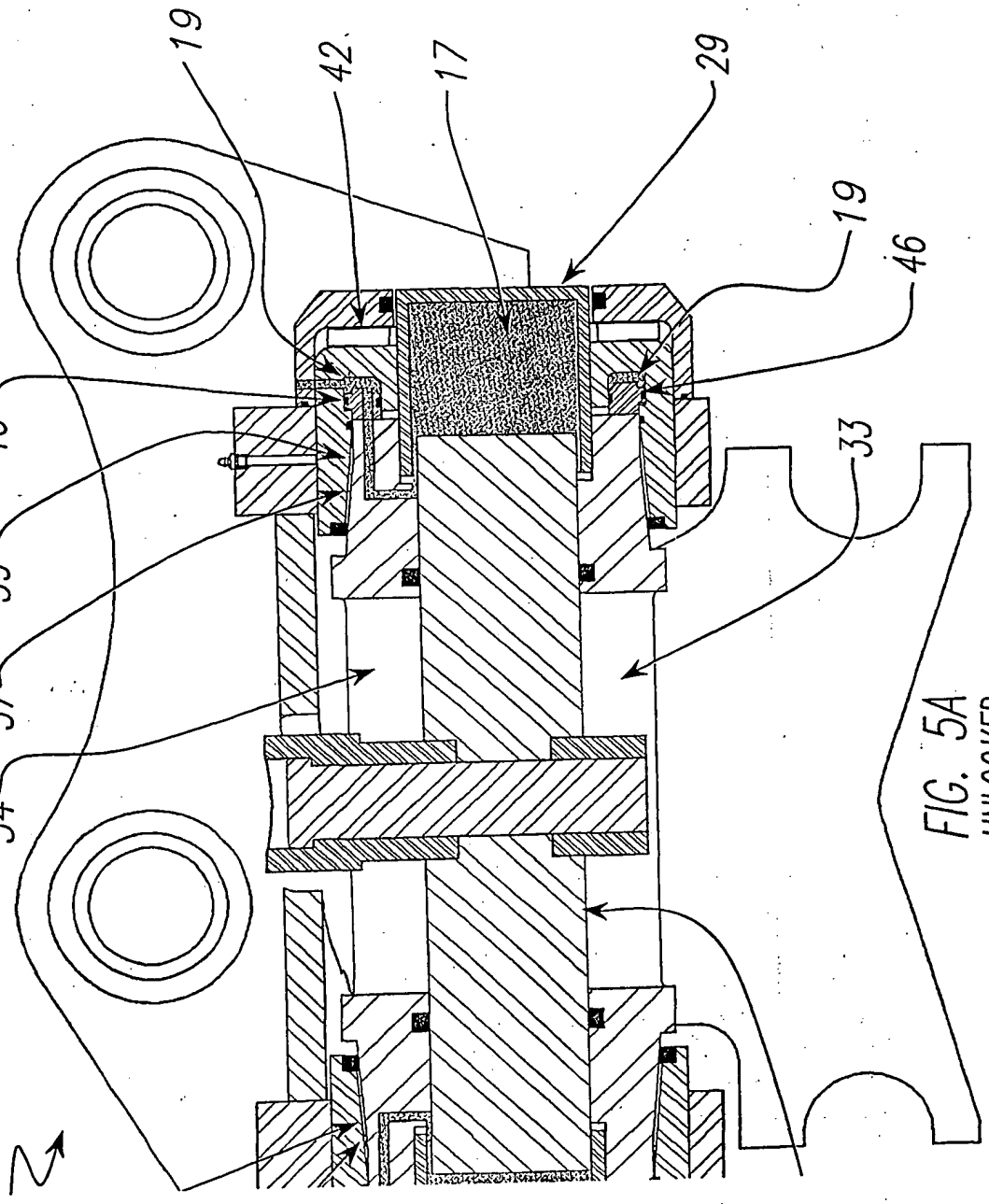

FIG. 5A
UNLOCKED

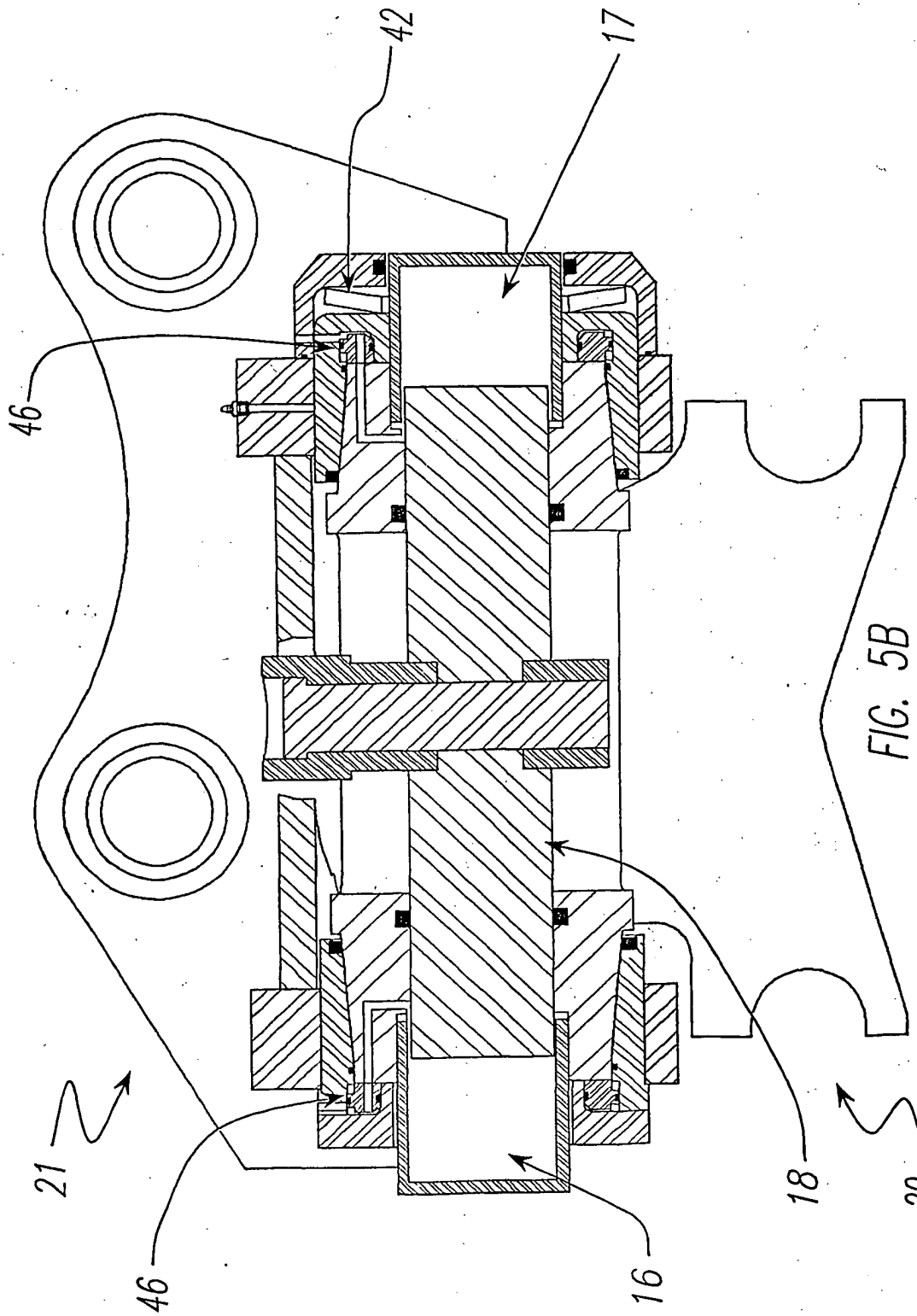

FIG. 5B
LOCKED

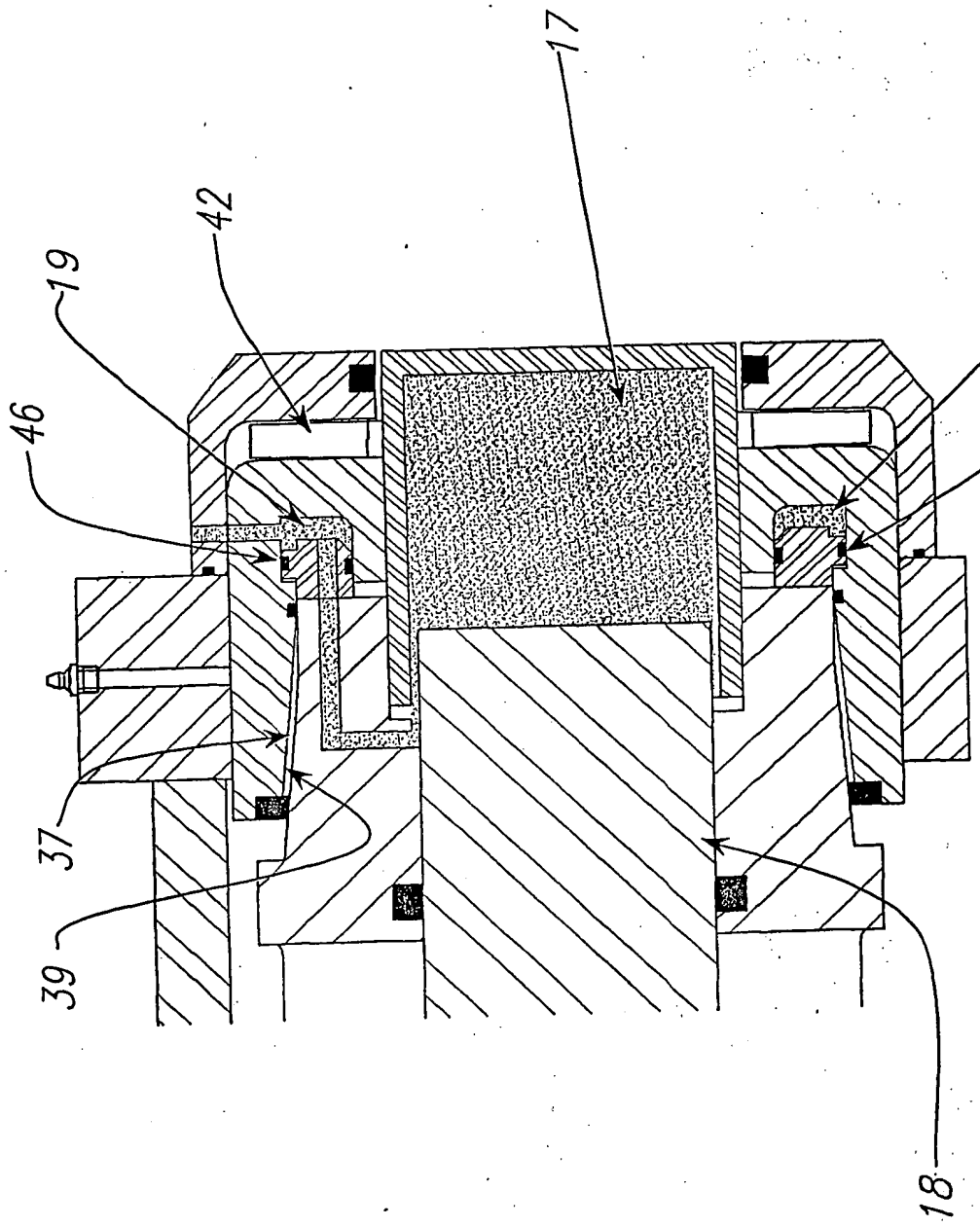

FIG. 5C
UNLOCKED

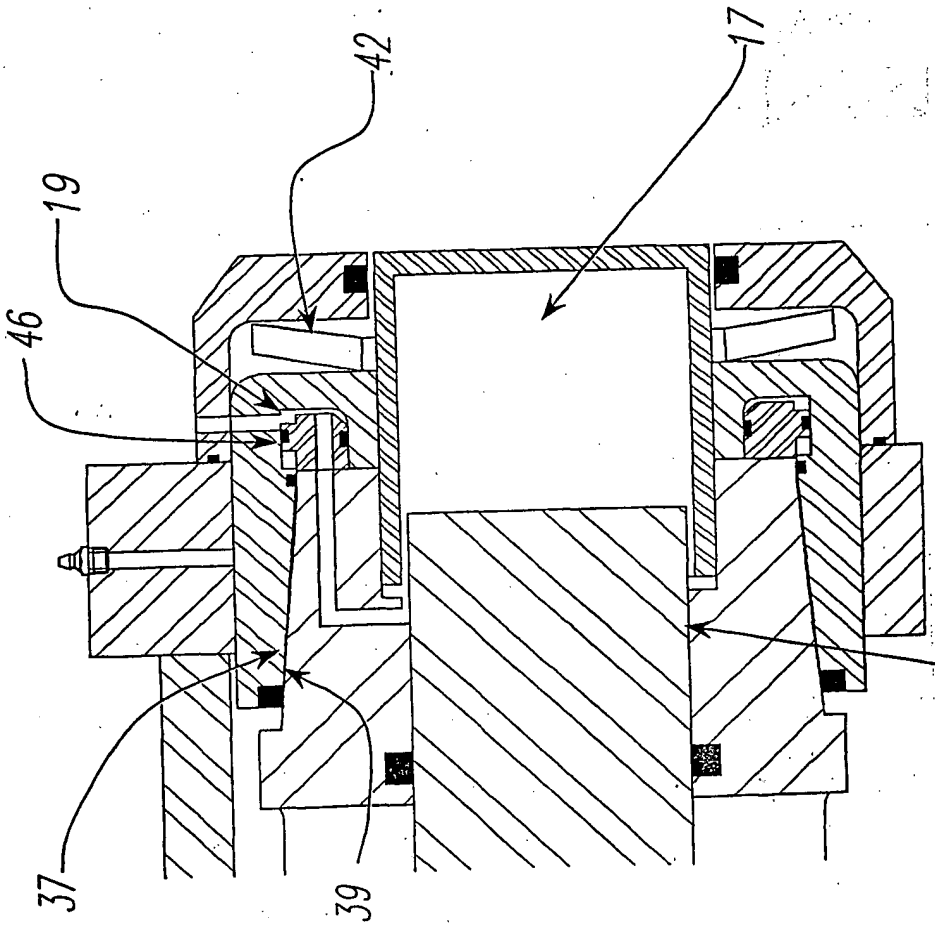

FIG. 5D
LOCKED

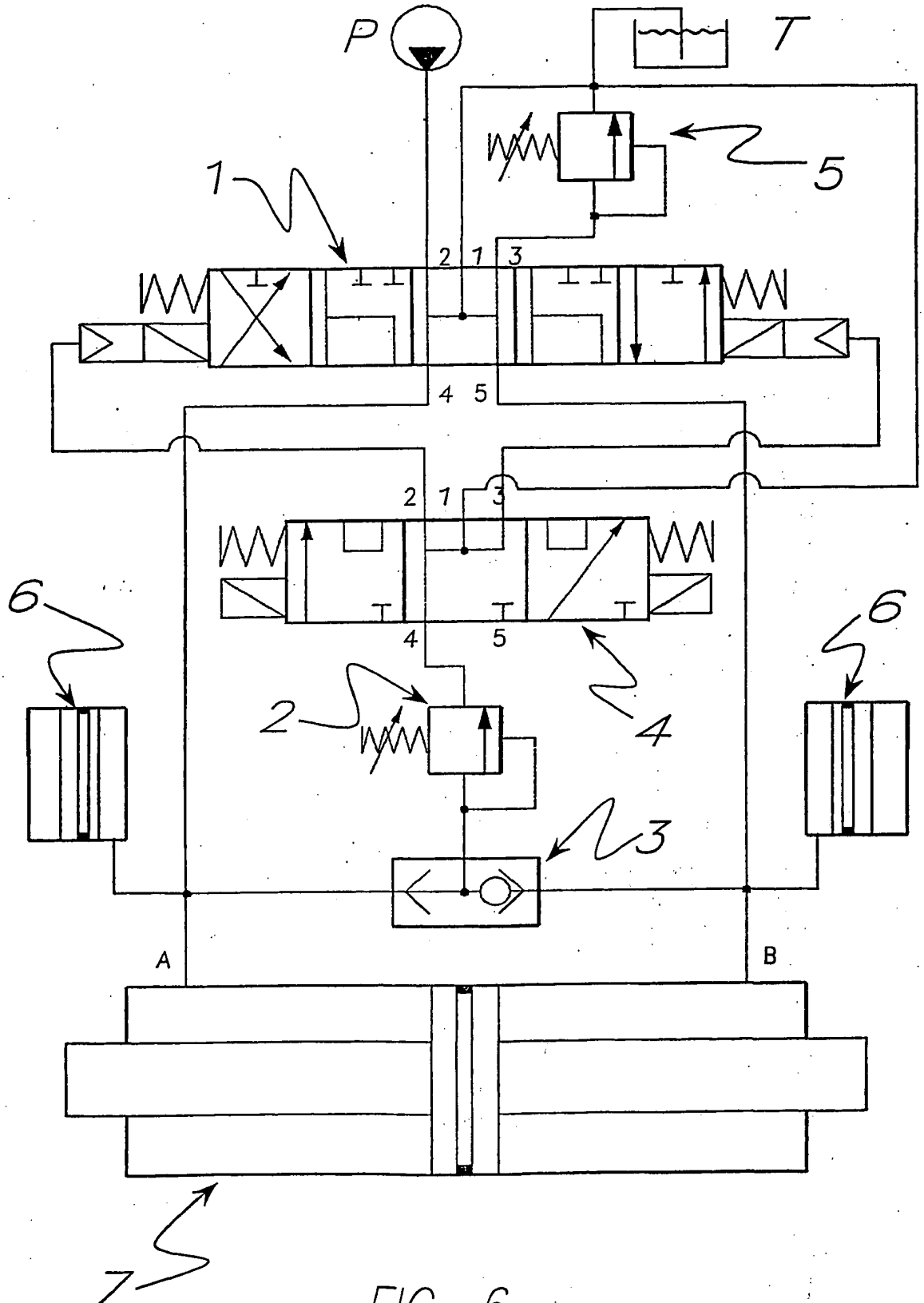

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 01/01083

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[7]: E02F 3/43, 3/50, E05B 51/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: E02F 3/36, 3/43, 3/50; E05B 51/00, 51/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT: LOCK + and ROTATE+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4745785 A (UEBERSAX) 24 May 1988 Column 2, line 50 - column 4, line 62 and figure 1	1
X	US 4771620A (KLEINHANY) 20 September 1988 The whole document	1
A	EP 356738 A1 (WEYER) 7 March 1990 Column 6, line 19 - column 14, line 48 and figures 2-6	1-13

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents:

"A" Document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 October 2001	26 OCT 2001

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 01/01083

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5145313 A (WEYER) 8 September 1992 Column 5, line 18 - column 10, line 62 and figures 2-6	1-13
A	AU 40383/95 A (1994 WEYER FAMILY LIMITED PARTNERSHIP) 20 June 1996 The whole document	1-13
A	WO 96/23935 A1 (KOZAKI) 8 August 1996 The abstract	1-13

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU 01/01083

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	475785	BR	8306645	CA	1198239	EP	119349
		JP	59170037	US	4521615	US	4590255
		BR	8306644	CA	1196145	JP	59170112
		US	4460738				
US	4771620	AU	63471/86	CH	668616	DE	3632904
		GB	2184772	JP	62273376	SE	8604803
EP	356738	US	4906161	AU	39221/89	BR	8903930
		CA	1303553	JP	2120425	US	4881419
		AU	25718/88	BR	8806271	CA	1292660
		EP	318805	JP	1193402	ZA	8808973
		US	4858701	US	5027667	AU	37141/84
		CA	1226149	EP	151788	JP	60179507
		US	4590816	US	4667528	US	4683767
		US	4691582	US	4741250	US	4838103
		US	4846007	US	4858486	US	4945778
		AU	80209/87	CA	1280008	EP	252423
		WO	8800295	US	4748866		
US	5145313	AU	22966/92	CA	2112135	EP	591442
		WO	9300486	US	5242258		
AU	40383/95	CA	2165151	EP	717153	JP	8246491
		US	5487230				
WO	9623935	JP	8197459	JP	8226139		

END OF ANNEX